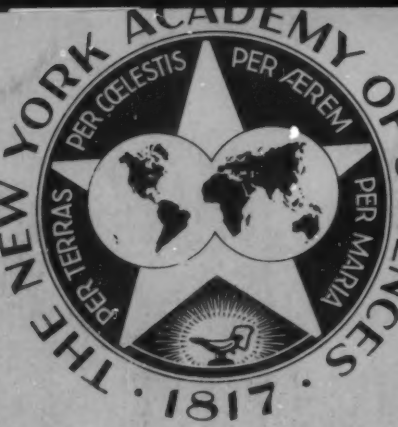

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CULTURE PATTERNS AND RESOURCE MANAGEMENT

Utilization of present scientific capacity for management and conservation of natural resources requires the application of relevant aspects of social science, according to Professor Paul B. Sears of Yale University.

In a paper presented before The Academy, Professor Sears analyzed divergent conservation activities, outlined the role of science and stressed the importance of social science in conserving natural resources.

The fact that "different individuals see different possibilities and wish for different benefits from the same resource or group of resources" has generated much apparent conflict of interest. Despite the different approaches to the problem - political, economic, aesthetic, ethical, or that of the natural scientist - the resources themselves are so interrelated that "all conservationists find themselves ultimately in the same position... the unifying thread is a responsible attitude of men toward environment," according to Professor Sears.

creative science

He sees science as an expression of "the creative impulse in man" and an "indispensable guide" to humanity's relationship to available resources. Until now science has been applied chiefly to the increased production of consumer goods, prolongation of life, and increased consumption of materials and energy.

From this situation comes what he calls the "rationalization known as the necessity of an expanding economy," which holds that human welfare is based upon more people using and discarding more things more rapidly. But since the total supply of raw materials is limited, Professor Sears likened this process to one in which society is living on its resource capital and is "treating depletion and depreciation as income rather than as liability."

It is lamentable, he believes, that the "apostles of an expanding economy and population" fail to provide room in their concept for that law of physics which in effect states that "when dynamic units are confined in space, any increase in numbers or energy diminishes the measure of freedom of each unit. Men no less than molecules are dynamic units." Since earth and its resources are finite, the rate at which population and consumption are multiplying poses the fundamental question of when, where, and on what basis "dynamic equilibrium" is to be reached.

Professor Sears states that social science has, along with medicine, until recently been too much "preoccupied with pathology, too little concerned with health and the normal. There was an important difference, however. The physician generally knew sickness when he saw it. The student of society was inclined to regard any system but his own as somehow abnormal. Thus he furnished a kind of intellectual justification for missionary and colonial effort, and for the expansion of trade at whatever cost to other social systems, their resources, and environmental adjustments. Africa, for example, was in excellent ecological balance until invaded by Europeans."

culture logic

The operative basis of social science has now changed: The assumption is that each society has evolved from an internal logic the values and patterns of behavior that constitute its culture. This culture must be studied from "inside," and social scientists who do so have amply justified themselves, Professor Sears believes.

In his examination of Culture Patterns and Resource Management, Professor Sears lists two principle considerations: One is the decisive role of intangible cultural values in shaping standards of behavior; the other is the function of culture patterns in relation to environment. Modification or correction of a society's abuses of its resources requires alteration of the culture pattern. Changes in patterns must be brought about by existing dynamics provided by the culture itself, since these are the values and sanctions that determine behavior.

An illustrative example given is that in which efforts by technical personnel to cause a group of Southwestern Indians to change destructive land-use practices were futile. When, however, a rodeo rider of championship caliber moved into the area and espoused the recommended changes, the Indians were moved to comply with them. Another example from our culture is that which took place in timber conservation. The managerial imperative of maintaining a profitable source of raw materials caused the private enterprise pulp and paper industry to institute great improvements in timber cutting and reforestation.

central dilemma

Professor Sears believes that our pattern of culture has "instruments of change consciously built into it whose effectiveness is evident in soil-conservation districts, watershed and... special organizations national and local too numerous to mention, yet most effective in the aggregate."

He questions, however, our failure to come to grips with the "central dilemma in resource management is our culture," which is the philosophy of unlimited expansion. "Only when substantial numbers of our citizens have absorbed confidence in the order of nature and can view themselves in the perspective of human experience can we expect that responsible attitude toward our environment that I have called conservation." **

TSETSE FLIES: OVERLORDS OF 4 MILLION SQUARE MILES OF AFRICA

An African land mass greater than that of the United States is dominated by parasitic diseases transmitted by tsetse flies. As carriers of several species of trypanosomes responsible for sleeping sickness in human beings and nagana in cattle and horses, tsetse flies are regarded by epidemiologists as perhaps the greatest barrier to the economic and social development of Africa.

In a paper presented at The Academy, K. C. Willett of the West African Institute for Trypanosomiasis Research stated that "the most serious medical problem of trypanosomiasis is no longer the human disease at all but the malnutrition and protein deficiency that results from the impossibility of keeping productive cattle in vast areas because of the certainty that they will die of trypanosomiasis."

Trypanosomiasis requires a broad, multi-disciplinary approach including human and veterinary medicine, entomology, protozoology, biochemistry, immunology, sanitary engineering and social science. Over-all administration demands judicious balancing of economic, sociologic and political factors. When, for example, an area is cleared to make possible the introduction of cattle, owners must be brought to cooperate to prevent overstocking and attendant soil destruction through erosion. Opposition to herd control frequently affects tribal as well as economic and political relationships.

All species of the fly require the bush cover provided by rain or riverine forests, thickets and shaded locations; there they breed and deposit their larvae at intervals of about nine days. Vegetation cover is a prime factor in the density, movement and activity of the tsetse population. Each species of fly also has its particular requirements as to humidity, temperature, evaporation and light intensity. Fly infestations are neither continu-

ous nor uniform. Many "fly belts" are separated by fly-free areas, and infested regions contain tsetse-free settlements.

Theoretically, the immense tracts now dominated by tsetse flies could be reclaimed for human use through insecticides applied as smoke and aerosols. Practically, however, this would require an outlay of vast sums. As an example, after five years of eradication efforts, the World Health Organization estimates that an additional $1.6 billion will be needed to complete its malaria-control program.

Immunological research in trypanosomiasis has been disappointing, due to the fact that virtually no common immunologic characteristics have been found in the many subspecies and strains. Prophylactic treatment in man for one form of the parasite has met with considerable success, and trypanicidal drugs are available for use in both man and animal.

In comparable epidemic situations, it has been found that eradication of only part of the infectious organisms or carrier population may give rise to resistant strains. The world-wide hospital experience with the development of antibiotic-resistant staphylococci, in which the depopulation of nonresistant organisms permitted the resistant strains to proliferate to epidemic proportions, may be cited as an example. Still another aspect of the problem is that of prolonging the eradication program sufficiently for the infectious agent to disappear from infected people and animals to preclude restarting the disease cycle.

At present, the program to control the tsetse and its diseases takes the form of discriminating use of insecticides and trypanicides, spot clearing of wooded areas, and controlled burnings of bush and grass.

A World Health Organization report points out that "human settlement with appropriate density of people" will eradicate the tsetse flies, but this invokes considerations even larger than those posed by their elimination through mass application of insecticides.

For the present, the flies maintain an effective blockade of a land mass otherwise suitable to the needs of a human population of hundreds of millions. ✱✱

LIFE FORMS IN SPACE

The extrapolations on the mathematical probability of life forms existing in space have now been justified in the report through The Academy of the discovery in the Orgueil meteorite of organic compounds produced by living matter in space, and the subsequent recovery from another meteorite fragment of extraterrestrial microorganisms.

The first physical evidence of the existence of living matter in space resulted from the work of a research team of three scientists, headed by Dr. Bartholomew Nagy, Vice-Chairman of The Academy's Section of Geological Sciences and Professor of analytical chemistry at Fordham University. His co-workers were Professor Douglas J. Hennessy of Fordham, and Dr. Warren G. Meinschein of the Esso Research Center.

Their findings were based upon distillates of a fragment of the Orgueil meteorite which fell in France on May 14, 1864. Using advanced analytic techniques in infrared and ultraviolet spectroscopy, X-ray diffraction and high-molecular-weight mass spectroscopy, they detected hydrocarbon molecules similar, but not identical, to certain organic waxes known on earth. Their conclusion: "Based on these preliminary studies, it appears that biogenic processes occur and that living forms exist in regions of the universe beyond our earth."

Shortly after their findings were announced, workers at the National Institutes of Health reported that they had successfully cultured in series organisms discovered in a meteorite that fell at Murray, Kentucky, in 1950. These living particles from space measure 12-millionths of an inch and are dissimilar to any known life form on earth.

The philosophic speculations as to whether we were alone in the universe changed to suspicions that we were not when, early in the 19th century, there was found evidence of what was interpreted to be vegetation on Mars. Schiaparelli called the Mars streaks "channels," but enthusiasts placed another interpretation on the Italian word "canali," and began to guess at the identity of the builders of the "canals" on the red planet.

Modern astronomers and other scientists are divided both as to the existence of the canals and vegetation. One theory suggests that a primitive green vegetation may exist there and live by photosynthesis.

The noted astrophysicist Harlow Shapley has maintained for years that it is ridiculous and vain of man to suppose that he is alone or superior in the universe. The recent program organized to broadcast signals to and receive possible messages from deep space was based upon acceptance of the likelihood of the existence of life forms with an intelligence of at least the order of our own. The program called for sending and listening on the 21-centimeter radiowave emitted by hydrogen clouds in intergalactic space, this being considered the most likely intrauniversal standard to be used by any intelligent life in the cosmos. Messages would be distinguished from random cosmic noise by regularity of pattern.

Discovery of the source or sources of life forms in other areas of our solar system would be of the greatest significance. Many authorities are insistent that full sterilization procedures be carried out on our space vehicles before they leave the earth's atmosphere, lest we contaminate other planets or satellites. Of equal importance to earthlings is decontamination of returning space probes to prevent their bringing back to earth virulent microorganic or biochemical materials capable of affecting life forms on our planet. Their remoteness from our conventional sciences might preclude development of defenses against them, with the prospect of obliteration of our life systems.

CLIMATE:
ITS MAKING AND MODERATION

The conversion of matter into energy equivalent to the explosion of millions of hydrogen bombs takes place within the sun each second. Some 50,000,000 years later this energy reaches the sun's surface and the intensity of its radiation affects the climate on earth.

The relative amounts of three gases within the atmosphere - carbon dioxide, ozone, and water vapor - are believed to control the earth's weather. Geological research in the past century has left no doubt that considerable fluctuations in the amount of carbon dioxide, water vapor, and ozone in the atmosphere have occurred throughout the geological history of the earth. In a paper presented before the Academy's symposium on Solar Variations, Climatic Change and Related Geophysical Problems, Dr. Gilbert N. Plass reported that the physical processes of emission and absorption of infrared radiation by ozone, carbon dioxide, and water vapor are now sufficiently well understood that it can be said with certainty that variations in the amount of any one of these three gases in the atmosphere cause changes in the equilibrium temperature of sufficient magnitude to influence the climate.

Bursts of solar ultraviolet radiation increase the amount of ozone in the upper atmosphere enough to raise the temperature at the surface of the earth several degrees centigrade.

Carbon dioxide has a warming effect on the atmosphere. The concentration of carbon dioxide is increasing at a rate of 30 per cent a century. It is being added to the atmosphere by the burning of fossil fuels at the rate of ten trillion tons per year. By the year 2,000 this rate is expected to increase to five times the present figure. So far, the average temperature rise observed in the twentieth century is very close to the theoretical increase (1.1°C. per century) predicted from those activities of man, such as clearing forests, draining and cultivating lands, and industrial processes,

which add carbon dioxide to the atmosphere. If industry continues to grow at its present rate, the known carbon dioxide reserves of coal and oil will be used up in 500 years. The atmospheric carbon dioxide amount will be ten times its present value. The corresponding temperature rise will be 12.2°C. Thousands of years later, as atmospheric carbon dioxide is absorbed in the oceans, the average temperature will then be 7.0°C. warmer than today.

Variations in carbon dioxide in the atmosphere have been related to periods of mountain building and glacier formation. Plass considers it probable that during a period of mountain building, increased amounts of carbon dioxide are released from the interior of the earth by new volcanoes and hot springs.

The cooling which might be expected while volcanic dust throughout the atmosphere blocks out infrared radiation is offset by the warming effect of the carbon dioxide. Gradually, the additional carbon dioxide is removed from the atmosphere by the process of rock weathering, and glaciation sets in if the volcanic dust has not settled. The length of an ice age is determined by the amount of carbon dioxide in the atmosphere. At the present level, it takes 15,000 years to melt an ice sheet one kilometer in thickness.

The effect of water vapor in the atmosphere is to increase the downward infrared radiation reaching the earth's surface, thus raising the average surface temperature. In turn, since warmer air holds more moisture, more infrared radiation reaches the surface and causes further warming.

In Dr. Plass's words: Variations in the atmospheric constituents are correlated with past geological events. The predicted influence of these events are then compared with the geological record. Quantitative estimates of the temperature change accompanying some of these variations are attempted. When the observed climatic variations agree with the reasonably simple and natural predictions of this theory, then it is reasonable to conclude that these factors may have been the dominant ones during that particular epoch."**

Chemical Development and Biochemical Manipulation

Chemical discoveries and diagnostic developments during the last 10 years have supplied great impetus to the increasing number of researchers who seek the molecular structures of mental processes. The millions of persons under treatment with tranquilizers, psychic energizers, and cerebral depressants or stimulants are providing a vast new body of clinical experience.

As the most pervasive of psychic derangements, schizophrenia has come in for particularly intense study, and it is now widely believed that this disease originates in disturbances of normal metabolism. Since 1954, when D. W. Woolley of The Rockefeller Institute presented data to support his theory that schizophrenia results from faulty serotonin metabolization, this neurohormone has been under the closest examination.

Serotonin is a substance similar to, but more potent than, epinephrine. It has been demonstrated that depression occurs when there is a lack of it in brain tissues, and excessive amounts are associated with agitation and aberration. The Academy's conference on Some Biological Aspects of Schizophrenic Behavior brought together international authorities for a pooling of research experiences regarding the chain of molecular events whose product is schizophrenia.

Predictable Patterns

The difficulties encountered in attempting to arrange these experiences into predictable patterns are immense. For example, Dr. E. Costa of the National Institutes of Health showed that while brain levels of serotonin are normally depleted under the tranquilizing

influence of reserpine, the same drug produces exactly the opposite reaction – agitation – when a monamine oxidase (MAO) inhibitor blocks the release of serotonin. Under these circumstances, other neurohormones are released to cause varying degrees of mental disequilibrium.

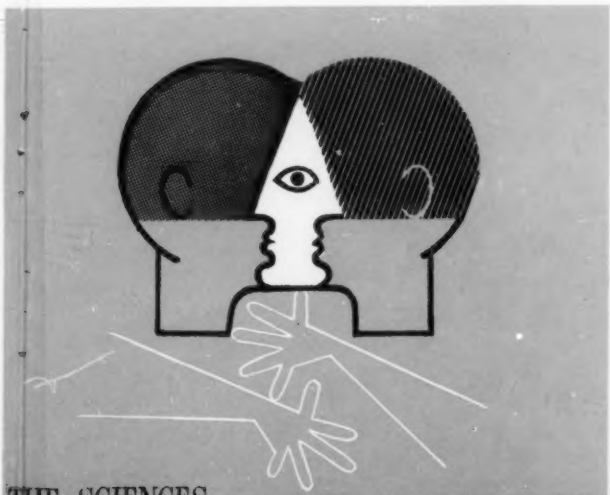
Psychotomimetics

In the attempts to discover the molecular changes in body chemistry associated with schizophrenia, drugs such as mescaline, LSD, and the phenothiazines are used to create symptoms that mimic those of psychotic states. These "psychotomimetics" too have produced many incomplete, hence apparently contradictory, findings. Dr. George G. Haydu of New York's Creedmoor Institute of Psychobiologic Studies showed that while it appears that the serotonin-depressing effects of chlorpromazine are involved in effects on schizophrenic behavior, chlorprothixene, an agent with much greater antiserotonin activity, has practically no effect on schizoid patterns. This would indicate that the problem is far more complex than simply whether or not brain levels of serotonin can be controlled. Dr. Woolley now advocates the examination of serotonin in the cellular structures of the nervous system (rather than from gross brain homogenates), as it seems probable to him that its possible effects on mental activities may arise from localized cerebral regions. Although his group has developed an analytic technique to permit direct examination of cerebral cortex extracts from schizophrenic patients and controls they have not yet found significant differences in serotonin content between normal and schizophrenic individuals.

Dr. Siva Sankar, Creedmoor State Hospital and Conference Chairman, however, reported that serotonin uptake by the blood platelets in schizophrenic children is less than in normal ones. A number of other investigators announced evidence showing the existence of some as yet unindentified factor in the blood of schizophrenic patients; when injected into experimental animals, it alters their responses and general behavior. Just what this factor is and what molecular processes produce it remain to be determined.

Dr. J. L. Fuller, Roscoe B. Jackson Memorial Laboratory, Bar Harbor, Maine, suggested that even temporary chemical imbalances during early life could set the molecular stage for later and damaging changes in behavior patterns. Slight alterations in metabolism may have immediate and profound effects on biological patterns. Dr. Roland Fischer of the Columbus, Ohio, Psychiatric Institute reported his studies establishing a definite relationship between life span and metabolic rate as measured by oxygen consumption. Men have a higher metabolic life rate than women, and thereby a shorter chronological life.

The voluminous, sometimes disparate, and often contradictory data presently accumulating from research in mental disease is creating a body of knowledge from which fuller understanding of mentation will be synthesized. The remarkable benefits now being derived from the molecular or chemical approach to treatment of patients once considered hopelessly ill merely hint the import that elaboration of the metabolism of mentality will hold for society. □□



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